

A SIMPLE DEVICE FOR COLLECTING BLOOD SAMPLES FROM SUBJECTS  
UNDERGOING ACCELERATION IN A CENTRIFUGE

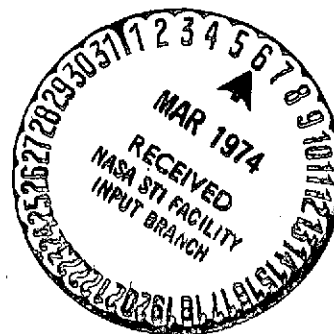
F. Rossangio

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16. Abstract  Description of a device for the appropriate collection of blood samples from subjects undergroin forces of acceleration. It consists of two collection units, each equipped with two syringes which permit the collection of two useful blood samples by means of a catheter located inside the circulatory system of the patient to be examined, while the centrifuge is in operation. The blood-collection unit is calibrated to permit the gathering of samples of venous and arterial blood during operation of a centrifuge to 15 g.			
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All spheres of scientific research are deriving conspicuous benefit from /77\* technological and technical progress.

In the field of studies relating to aeronautical and space medicine it has been possible in recent years to carry out many important experiments which have yielded broader and more precise knowledge in the enormous problem of human flight, both in the atmosphere and in space, by the use of new highly sensitive systems for detection of biological phenomena (electronic manometers, photo-plethysmographs, permanent electrodes, polarographic gas analyzers, and so forth), and particularly by means of improved remote radio transmission methods of the electric potentials correlated with the phenomena themselves or ones to which such phenomena can be converted.

In any sector of scientific research, however, for example in the field of study of the effects of acceleration, which generally is conducted in the laboratory using a centrifuge, at times particular problems of a technical nature arise which cannot be solved by use of the apparatus normally employed under other research conditions. In this instance difficulties are encountered in the /78 recording of almost all the measurements of biological parameters, difficulties due basically to the main characteristic of the centrifuge. The centrifuge chamber, and along with it the subject in it undergoing testing, cannot be connected continuously with the measurement apparatus situated in the observation chamber, whenever the former are in motion and rotating about the axis of the centrifuge.

It is not possible, on the other hand, to mount the scientific instruments (or at least the majority of them) in the centrifuge chamber situated at the end of the centrifuge arm, both because of their weight and the obstruction they represent and especially because they are not designed to withstand the forces of acceleration, or because the measurements they provide are less accurate from being altered by the acceleration itself.

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\*Numbers in the margin are the pagination from the foreign text.

Hence the necessity of employing special devices (rotating collectors, radio transmission of signals, and so forth) permitting connection of the detectors or sampling systems to recording and data gathering devices.

For certain types of measurements, such as oximetric ones, use cannot be made of the customary apparatus, as in ordinary laboratories, when it is desired to give preference to the technique of continuous and simultaneous in vivo measurement with arterial blood. In this instance it is necessary to resort to oximeters suitably designed and constructed to operate in a centrifuge (Barr and Bjursted, 1963).

If such measurement resources are not available,] one can resort to analysis in a dish of blood samples taken at a distance and at a suitable time and subsequently analyzed with a standard oximeter.

A device suitable for proper taking of blood samples from subjects undergoing forces of acceleration has been devised and built for this purpose at the CSRMAS [Centro di Studi e Ricerche di Medicina Aeronautica e Spaziale; Aeronautical and Space Medicine Study and Research Center].

It consists of two sampling units each made up of two "Record" syringes (Figure 1) making it possible to obtain two useful blood samples through catheters while the centrifuge is in motion.|

The device operates specifically as follows (Figure 2). A catheter inserted into the circulatory system of the subject to be tested is connected to a three- /79-way metal cock (5). The latter is arranged initially] so as to connect the catheter to a first syringe (6). The filling of this] first syringe, which may be defined] as a "washing" syringe, serves to collect the amount of blood standing in the catheter and the cock and obviously not circulating in the circulatory system of the individual, which blood should thus not be taken into account for oximetric analysis. As with all other syringes, the sample is obtained through disengagement of a stop rod (12) by a remote-controlled electromagnet (13). The plunger of the syringe is thereby released and is free to travel, being pulled by a calibrated spring (9) as far as set screw (10). In this way it is possible to determine the amount of blood which is to be taken.

Once the first washing sample has been obtained, one can immediately proceed to obtain a sample useful for oximetric measurement by operating the electromagnet controlling release of the plunger of the second syringe (4), after the flow of blood has been diverted from the first syringe (6) to the second (4) by means of the three-way cock controlled by release mechanism (1) of electromagnet (2), which releases return spring (3).

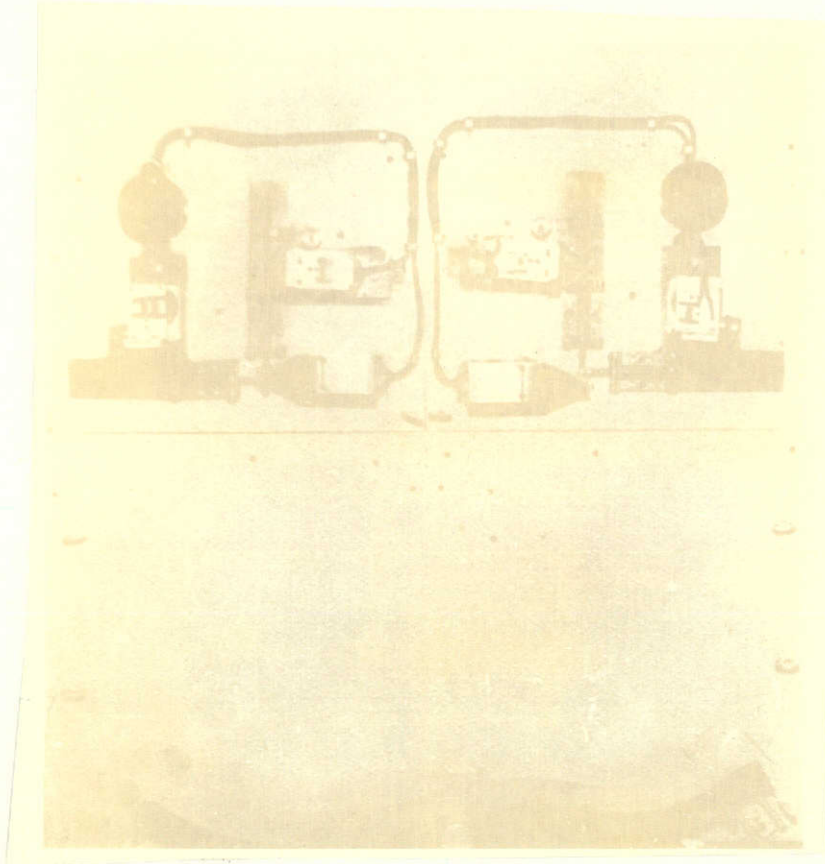


Figure 1. See Text for Explanation

The position of the syringes relative to the three-way cock can be adjusted on the panel by means of screws (8). The latter are secured firmly between screw clamps for rapid replacement (7). They are generally lubricated with silicone lubricant, and the amount of anticoagulant liquid in them before the blood sample is taken is determined by an adjustable screw (11).

Figure 1 clearly shows the portion relating to electric power supply of the electromagnets, which is in the form of 24 volts direct current. Also to be seen

in the lower half of the illustration is the space reserved for the animal subjected to testing. This space is bounded at the bottom by a limiting frame suitable in this case for experiments involving animals subjected to +Gx acceleration. The sampling device is calibrated so as to permit the taking of samples of venous or arterial blood by means of catheters during movement of the centrifuge up to values of 15 G.

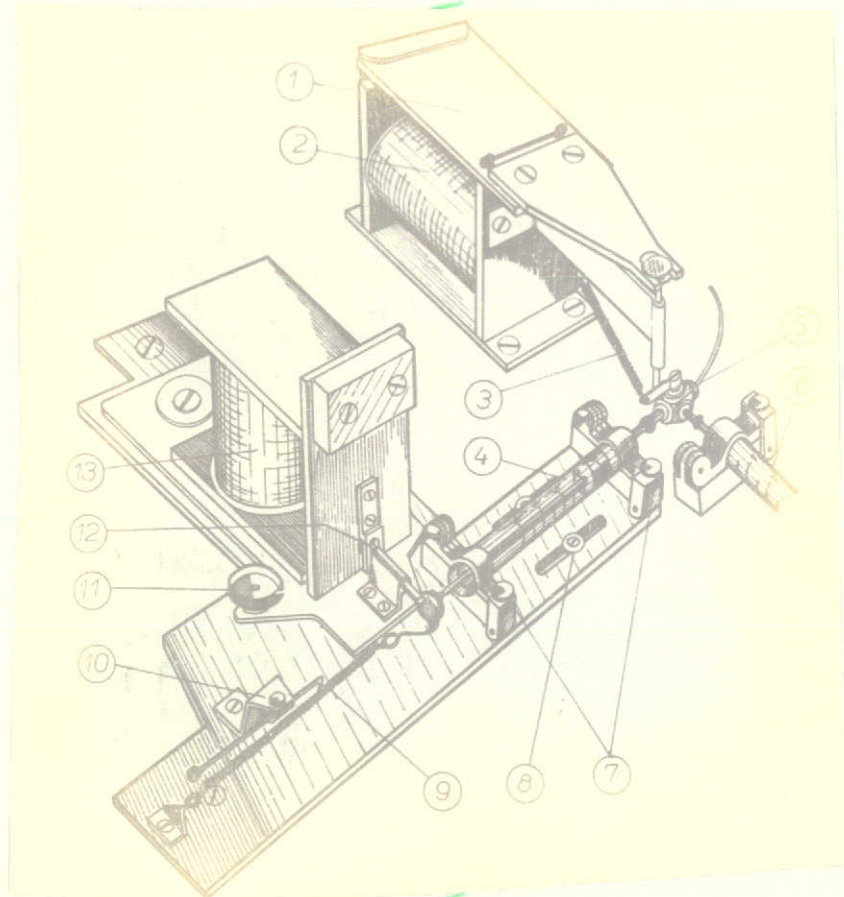


Figure 2. See Text for Explanation.

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